



Norovirus - what is it?

Introduction

Noroviruses are one of the major causes of gastroenteritis in children and adults, and are recognised as the leading cause of outbreaks of gastroenteritis in the industrialised world. Norovirus disease is considered relatively mild in terms of severity and duration, but it is estimated that on average 80 deaths a year are associated with norovirus infections in those aged 65 and over. In addition norovirus outbreaks are responsible for great economic losses most notably to the health and tourism sectors, and they contribute very significantly to the winter pressures experienced every year in the health sector. There is a high rate of person to person transmission, a low infectious dose, and apparent environmental persistence resulting in persistent and recurring outbreaks. The cost of outbreaks to the NHS in England alone is estimated to be £115 million per annum with considerably greater cost to the wider population – as many as 2.8million people were estimated to have contracted NoV in the winter outbreak of 2008.

Norovirus gets its name from the place of Norwalk USA following an outbreak of disease that led to its discovery. Historically, this disease is known as “winter vomiting disease” owing to its seasonal peak of infection. Noroviruses are diverse and a number of different variant viruses have been named following outbreaks occurring in different places e.g. Southampton, Hawaii, Mexico and Framlington Hills. Molecular biologists have characterised these variants and developed typing schemes dividing noroviruses into genogroups with further subdivision into genotypes. Humans are most commonly infected by genogroups I and II norovirus. Certain genogroups can predominate such that currently genogroup II genotype 4 is most commonly associated with disease. Norovirus infects all age groups and infection generally results in an unpleasant but self-limiting gastroenteritis accompanied by diarrhoea and projectile vomiting. Norovirus is occasionally lethal in the elderly and immuno-compromised although some individuals appear to carry the virus with no ill effect. Recently it was found that human noroviruses bind human blood group antigens (HBGAs) which may act as receptors for the virus. However susceptibility to GII.4 norovirus infection appears independent of HBGA but is dependent on secretor status (i.e. the ability to secrete antibodies

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into bodily fluids such as saliva). Non-secretors of HBGAs which comprise approximately 20% of the population can appear resistant both to GI and GII.4 norovirus infection. However resistance to infection appears to vary dependent on the particular genogroup and genotype

So where does norovirus come from and how does it spread?

Although NoVs may be found in other animals these viruses belong to different genogroups and do not appear to infect humans. Current data suggest that human noroviruses are specific for their human hosts. However recent data have suggested that human NoVs can be found in pet dogs but it's not clear as yet if the virus can grow in dogs or is just occasionally carried. In general, norovirus is spread by person to person contact and contaminated food, water and fomites (inanimate objects). Person to person spread is very common and therefore high human population density favours the spread of this disease. This is particularly obvious when outbreaks occur in hotels, cruise ships and hospital wards attracting great media attention but in reality transmission in these places may be no different to any other place where people gather. The contribution of food to Norovirus infection compared with person to person transmission is difficult to measure in isolation and difficult to separate from the contribution of the environment and food handlers. In the USA norovirus is associated with 50% of all foodborne disease but apparently less so in the UK although this may be due to differences in reporting. Unlike bacterial pathogens viral pathogens such as noroviruses cannot grow in food. However certain foods consumed raw that may come into contact with untreated sewage such as shellfish and occasionally fresh produce may be associated with contamination. This contamination may result from sewage overflow onto into the water supply, recreational waters, and agricultural land or from food handlers. An episode of contamination of raspberries exported from Poland in 2009 resulted in a global spread of disease through consumption of contaminated frozen fruit used in unprocessed food products. In general most cases of food poisoning are associated with foods consumed outside the home and may be linked to food handlers involved in the preparation of food. Additionally, the general public is not exempt and needs to remember the message to wash hands after visiting the lavatory and before eating. A large number of potential environmental sources resulting from faecal contamination leading to faecal-oral transmission e.g. the handling of cash in tills, contamination of cutlery in buffet style meals, contamination of ice in ice buckets etc.

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What control measures are effective in limiting the spread of norovirus?

Obviously personal hygiene is important but we don't really know for certain what control measures work and what do not. The reason for this is partly because we cannot cultivate noroviruses and therefore cannot directly measure the effect of inactivating agents. In order to overcome this problem scientists have examined the behaviour of related viruses such as feline calicivirus and the murine norovirus (which is a patented virus and the only known cultivable norovirus). However the use of pure cultured viruses for inactivation studies has its limitations since human norovirus may be present on surfaces and within a faecal matrix. Recently two different approaches have attempted to overcome this problem of studying non-cultivable human norovirus in its "natural" state. The first of these is to measure the intrinsic properties of the virus in contaminated faecal samples e.g. the integrity of the virus capsid or genome, or secondly to conduct human volunteer studies. Virus capsid integrity assays have shown that currently available disinfectants and sanitizers e.g. alcohol based hand washes, are relative ineffective at destroying the human norovirus capsid when present in dilute faecal samples and the virus also appears more heat resistant. However when surrogate feline calicivirus is spiked into the same contaminated faecal sample it too appears more resistant. This suggests that the difficulty of inactivating human noroviruses may be associated with the faecal matrix and not the virus per se. Human volunteer studies have also shown that noroviruses may persist in groundwater for at least 61 days and still retain infectivity providing evidence that these viruses really can persist in the environment. For these reasons it is important to ensure adequate cleaning followed by strong disinfection treatment. Hygiene control measure should seek to minimise the risk of person to person transmission through provision of adequate toilet facilities and cleaning regimes particularly targeted at the points of human contact.

How do we know food is safe to eat and not contaminated?

This is a difficult question to answer. Traditionally, the food industry uses HACCP to control pathogenic microbes from growing in food, but norovirus does not grow in food and in reality should be considered a contaminant. The testing of food is destructive and adequate sampling difficult, so testing can only fulfil a limited but useful role in due diligence. Testing of food for noroviruses (and other foodborne viruses such as Hepatitis A) uses a molecular method based upon the polymerase chain reaction or PCR

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since this is the only method sensitive enough to detect norovirus in food and environmental samples. Standardised testing methods have now been developed by the European Committee for Standardization (CEN) in support of food safety legislation for, shellfish, water, fruit and salad vegetables and the swabbing of surfaces. Unfortunately a drawback of these proposed methods is that they cannot determine if the test result is associated with an infective or an inactivated virus particle and also there is a lack of a confirmatory test to confirm that the result is a true positive. Adequate control measures remain reliant on Good Agricultural Practice including the provision of washing and toilet facilities for agricultural labourers, adequate water supply, and sewage treatment facilities. It remains particularly important that all food handlers (and the public at large) maintain good personal hygiene and refrain from work if they have contracted a NoV infection.

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